

# TESTS OF FLAMMABILITY OF COTTON FABRICS AND EXPECTED SKIN BURNS IN MICROGRAVITY

Jane M. Cavanagh, David A. Torvi,<sup>1</sup> and Kamiel S. Gabriel  
Department of Mechanical Engineering  
University of Saskatchewan  
Saskatoon, SK

Gary A. Ruff  
NASA Glenn Research Center  
Cleveland, OH

During a shuttle launch and other portions of space flight, astronauts wear specialized flame resistant clothing. However during most of their missions on board the Space Shuttle or International Space Station, astronauts wear ordinary clothing, such as cotton shirts and pants. As the behaviour of flames is considerably different in microgravity than under earth's gravity, fabrics are expected to burn in a different fashion in microgravity than when tested on earth. There is interest in determining how this change in burning behaviour may affect times to second and third degree burn of human skin, and how the results of standard fabric flammability tests conducted under earth's gravity correlate with the expected fire behaviour of textiles in microgravity.

A new experimental apparatus was developed to fit into the Spacecraft Fire Safety Facility (SFSF), which is used on NASA's KC-135 low gravity aircraft. The new apparatus was designed to be similar to the apparatus used in standard vertical flammability tests of fabrics. However, rather than using a laboratory burner, the apparatus uses a hot wire system to ignite 200 mm high by 80 mm wide fabric specimens. Fabric temperatures are measured using thermocouples and/or an infrared imaging system, while flame spread rates are measured using real time observations or video. Heat flux gauges are placed between 7 and 13 mm away from the fabric specimen, so that heat fluxes from the burning fabric to the skin can be estimated, along with predicted times required to produce skin burns.

In November of 2003, this new apparatus was used on the KC-135 aircraft to test cotton and cotton/polyester blend fabric specimens in microgravity. These materials were also been tested using the same apparatus in 1-g, and using a standard vertical flammability test that utilizes a flame. In this presentation, the design of the test apparatus will be briefly described. Examples of results from the KC-135 tests will be provided, including heat fluxes and skin burn predictions. These results will be compared with results from 1-g tests using the same apparatus and a standard fabric flammability test apparatus. Recommendations for future microgravity fabric flammability tests will also be discussed.

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<sup>1</sup> Corresponding Author: Phone (306) 966-5493, Fax (306) 966-5427,  
Email: David.Torvi@usask.ca